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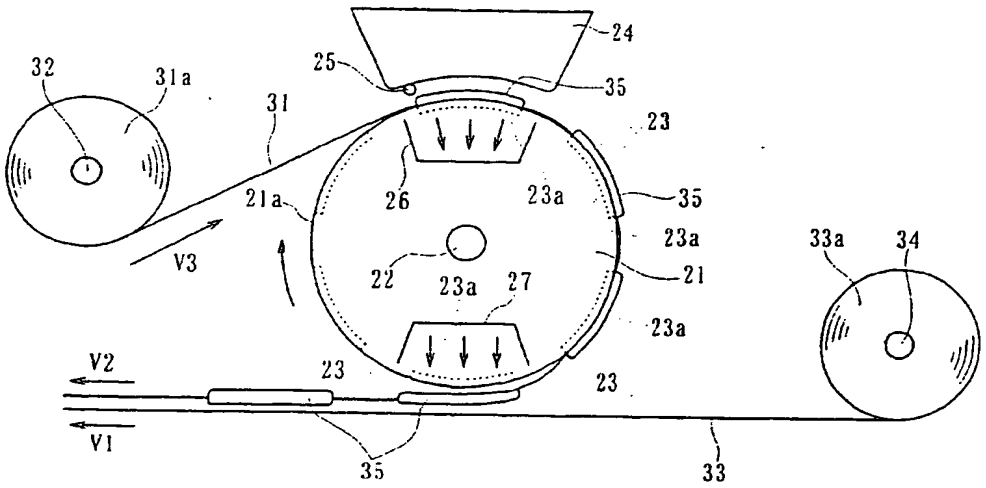
(54) Production method of absorbent body

(57) A production methoc of an absorbent body is provided. The method includes the steps of: supplying a first cover sheet (31) on an outer surface of a rotating pattern drum (21), said pattern drum (21) being provided with a concavity formed in a predetermined shape on the outer surface thereof; adapting the first cover sheet (31) to the shape of the concavity and supplying an absorbent material into the concavity to form an absorbent material layer adapted to the shape of the concavity on the first cover sheet (31); supplying a second cover sheet (33) toward the outer surface of the pattern drum (21); and separating the first cover sheet (31) together with the absorbent material layer from the outer surface of the pattern drum (21) and superposing the first cover sheet (31) together with the absorbent material layer on the second cover sheet (33) to produce an absorbent body comprised of the first cover sheet (31), the second cover sheet (33) and the absorbent material layer interposed between the first cover sheet (31) and the second cover sheet (33). The absorbent body produced by this method has improved absorption properties and may be used for disposable diapers, pet sheets, sanitary napkins or the like.

Fig. 1



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Description

[0001] This invention relates to a production method of an absorbent body to be used for pet sheets, disposable diapers, sanitary napkins, or the like.

[0002] Conventional production methods of the absorbent body are explained with reference to **Fig. 13** and **Fig. 14**.

[0003] In the conventional production method of the absorbent body shown in **Fig. 13**, a carrier tissue **2** is drawn from a roll **2a** which is supported by an axis **1** and is forwarded continuously. A pulp supplier **3** is provided above the carrier tissue **2** which is forwarded continuously. Crushed pulps are supplied from the pulp supplier **3** to be poured on the carrier tissue **2**. A supply nozzle **4** for supplying particulate SAP (super-absorbent polymers) is provided above the carrier tissue **2** and supplies the SAP on the carrier tissue **2** which is forwarded continuously.

[0004] A suction chamber **6** is provided in the opposite side of the pulp supplier **3** and the supply nozzle **4** with the carrier tissue **2** interposed. Crushed pulps and the SAP are sucked by the suction chamber **6** to form a strip of an absorbent material layer **5** comprised of a mixture of crushed pulps and SAP on the carrier tissue **2**.

[0005] In a speedy production, crushed pulps and SAP are continuously supplied onto the carrier tissue **2** to form a strip of an absorbent material layer **5**. Thereafter, a cover tissue (not shown) is supplied onto the strip of the absorbent material layer **5** to form a laminated body comprised of the carrier tissue **2**, a cover tissue and the absorbent material layer **5** interposed between the tissues. Subsequently, both sides of the laminated body are cut by a cutter such as a rotary cutter and thereafter the laminated body is cut into individual absorbent bodies.

[0006] In the conventional production method of the absorbent body shown in **Fig. 14**, the carrier tissue **2** drawn from the roll **2a** are forwarded continuously. A circular pattern drum **7** is provided above the carrier tissue **2** which is forwarded continuously. The pattern drum **7** rotates in the clockwise direction around the axis **8** at a speed adapted to the running speed of the carrier tissue **2**.

[0007] Concavities **9** are provided on the outer face of the pattern drum **7** at predetermined intervals. Mesh **9a** of a predetermined screen dimension is provided at the bottom of the concavity **9**. The concavity **9** is formed in a predetermined shape such as the shape of a sand-glass. A pulp supplier **11** is provided above the pattern drum **7**, facing the outer surface of the pattern drum **7**. Likewise, a supply nozzle **12** for supplying SAP is provided also facing the outer surface of the pattern drum **7**.

[0008] According to the production method of the absorbent body as shown in **Fig. 14**, crushed pulps are supplied from the pulp supplier **11** into the concavity **9** which is provided on the outer surface of the rotating pattern drum **7**. Also, SAP are supplied from the nozzle **12** into the concavity **9** in the same manner.

[0009] A suction means is provided inside of the pattern drum **7** facing the pulp supplier **11** and the supply nozzle **12** for sucking air through the openings of the mesh **9a** provided at the bottom of the concavity **9**. The crushed pulps and the particulate SAP are sucked to be placed onto the concavity **9** thereby forming the absorbent material layer **13** having the same shape as that of the concavity **9**.

[0010] At the time the concavity **9** faces the carrier tissue **2** in the course of the rotation of the pattern drum **7**, another suction means provided below the carrier tissue **2** sucks air through the carrier tissue **2**. By this suction, the absorbent material layer **13** is transferred onto the carrier tissue **2**. Subsequently, a cover tissue (not shown) is laid along the carrier tissue **2** and the absorbent material layer **13**, thereby forming a laminated body comprised of the carrier tissue **2**, the cover tissue and the absorbent material layer **13** interposed between the tissues. Thereafter, the carrier tissue **2** and the cover tissue are cut in accordance with the shape of the absorbent material layer **13** to produce individual absorbent bodies.

[0011] In a high speed production of the absorbent body according to the conventional production method shown in **Fig. 13**, because the absorbent material layer **5** is formed in a strip shape on the carrier tissue **2** in a continuous process, a rectangular absorbent body can be easily produced. However, it is almost impossible to produce an absorbent body having a desired shape such as sand-glass shape. Therefore, in order to produce an absorbent body having a desired shape such as sand-glass shape, it is necessary to conduct a trimming process to such laminated body in a press working process. That results in taking many processing steps.

[0012] In addition, in order to laminate another absorbent material layer on the absorbent material layer **5** formed by the conventional production method shown in **Fig. 13**, crushed pulps and SAP need to be sucked by the suction means through the carrier tissue **2** and the absorbent material layer **5**. However, because of the poor air permeability of the laminated layers formed of the carrier tissue **2** and the absorbent material **5**, it is almost impossible to form another absorbent material layer over such laminated body by sucking another crushed pulps or SAP by such suction means. For this reason, in the production of the absorbent body having two absorbent material layers laminated, each of the absorbent material layers needs to be produced separately by the method shown in **Fig. 13** and thereafter laminated each other. Therefore, it inevitably takes many production steps to produce an absorbent body having two absorbent material layers therein.

[0013] Moreover, in order to cut the above absorbent body having two laminated absorbent material layers therein, another cover tissue needs to be laid over the absorbent material layer at the upper side. Consequently, at least three tissue layers are needed, making the

production of the absorbent body costly.

[0014] On the other hand, according to the conventional production method of the absorbent body shown in **Fig. 14**, the absorbent material layer **13** can be formed in the same shape as that of the concavity **9** formed on the outer face of the pattern drum **7**.

[0015] However, in order to form the absorbent material layer **13** in the same shape as that of the concavity **9**, crushed pulps and particulate SAP need to be sucked into the concavity **9** by the suction force through the openings of the mesh **9a** provided at the bottom of the concavity **9**. In general, the opening size of the mesh **9a** is 60 meshes (according to the standard of Tyler, U.S. A., the opening size of such mesh is equal to 0.246mm).

[0016] However, because of the fineness of the SAP supplied to the concavity **9**, they easily pass into inside of the pattern drum **7** through the mesh **9a**, thereby rendering the yield ratio of SAP very poor. Owing to the passage of SAP through the mesh **9a** which results in a poor yield ratio of SAP, it is very difficult to increase the content of SAP in the absorbent layer **13**. Therefore, it is extremely difficult to produce an absorbent layer containing SAP 20% by weight or more.

[0017] Further, in order to accelerate the liquid absorption speed of the absorbent material layer, the particle size of SAP to be contained in the absorbent material layer must be formed very small. However, the mesh **9a** having the opening size of 60 meshes can hardly prevent such fine SAP from passing through into the pattern drum**7**. Therefore, it is almost impossible for the mesh **9a** to hold the SAP having a small particle size such as 100 mesh or less (which passes through a mesh having an opening size of 0.147mm) at the concavity **9**.

[0018] In addition, according to the conventional production method shown in **Fig. 14**, the absorbent material layer **13** must be sucked through the carrier tissue **2** by the suction means provided below the carrier tissue **2** at the time the concavity **9** faces the carrier tissue **2**. However, in order to suck the absorbent material layer formed in the concavity **9** through the carrier tissue **2**, a very strong suction force is needed. Consequently, the facility of the suction means inevitably becomes large, making the production cost very high.

[0019] Further, according to the conventional production method as shown in **Fig. 14**, it is very difficult to produce an absorbent body having two absorbent material layers laminated each other therein. Because sucking another absorbent material layer to place it on the absorbent body through the carrier tissue **2** and the absorbent material layer **13** by a suction means is almost impossible owing to the poor air permeability of the layers. Therefore, in order to produce an absorbent body having two absorbent material layers laminated therein, each of the absorbent material layer must be produced separately and thereafter laminated each other like in the production method shown in **Fig. 13**. Consequently, the number of steps for producing the absorbent body having two absorbent material layers laminated with each other therein is inevitably increased.

[0020] Also, similar to the production method shown in **Fig. 13**, in order to cut the above absorbent body having two laminated absorbent material layers therein, another cover tissue needs to be laid over the absorbent material layer at the upper side. As a result, at least three tissue layers become necessary, making the production of the absorbent body costly.

[0021] It is an object of the present invention to provide a production method of an absorbent body which can solve above problems by easily transferring the absorbent material layer formed in the concavity of the pattern drum onto the cover sheet without using a large scaled suction means of the conventional technology.

[0022] It is a further object of the present invention to improve the yield ratio of SAP to be contained in the absorbent material layer, thereby achieving the formation of an absorbent body containing an increased amount of SAP or fine SAP.

[0023] It is a further object of the present invention to provide a production method of an absorbent body which can laminate a plurality of absorbent material layers without using a cover sheet between the laminated absorbent material layers.

[0024] It is a further object of the present invention to produce an absorbent body by laminating a plurality of absorbent material layers wherein each layer may have different shapes, different SAP contents or the SAP having different particle sizes.

[0025] In order to achieve the above objects, the production method of the present invention comprises the following steps of:

(1) supplying a first cover sheet on an outer surface of a rotating pattern drum, said pattern drum being provided with a concavity formed in a predetermined shape on the outer surface thereof;
(2) adapting the first cover sheet to the shape of the concavity and supplying an absorbent material into the concavity to form an absorbent material layer adapted to the shape of the concavity on the first cover sheet;
(3) supplying a second cover sheet toward the outer surface of the pattern drum; and
(4) separating the first cover sheet together with the absorbent material layer from the outer surface of the pattern drum and superposing the first cover sheet together with the absorbent material layer on the second cover sheet to produce an absorbent body comprised of the first cover sheet, the second cover sheet and the absorbent material layer interposed between the first cover sheet and the second cover sheet.

[0026] In this production method, it is also possible that another absorbent material layer is formed on the second cover sheet, and the absorbent material layer formed on the first cover sheet is superposed on the ab-

sorbent material layer formed on the second cover sheet, between the first cover sheet and the second cover sheet.

[0027] Another production method of the absorbent body according to the present invention comprises the following steps of:

(1) supplying a first cover sheet on an outer surface of a first pattern drum rotating, said first pattern drum being provided with a first concavity formed in a predetermined shape on the outer surface thereof;

(2) adapting the first cover sheet to the shape of the first concavity and supplying an absorbent material into the first concavity to form a first absorbent material layer adapted to the shape of the first concavity on the first cover sheet;

(3) supplying a second cover sheet on the outer surface of a second pattern drum rotating, said second pattern drum being provided with a second concavity formed in a predetermined shape on the outer surface thereof;

(4) adapting the second cover sheet to the shape of the second concavity and supplying an absorbent material into the second concavity to form a second absorbent material layer adapted to the shape of the second concavity on the second cover sheet; and

(5) separating the first cover sheet together with the first absorbent material layer from the outer surface of the first pattern drum and separating the second cover sheet together with the second absorbent material layer from the outer surface of the second pattern drum and superposing the first cover sheet together with the first absorbent material layer on the second cover sheet together with the second absorbent material layer to produce an absorbent body comprised of the first cover sheet, the second cover sheet and the first and second absorbent material layers interposed between the first cover sheet and the second cover sheet.

[0028] Embodiments of the present invention, will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:

[0029] **Fig. 1** is a schematic diagram of the production method of the absorbent body showing the first embodiment of the present invention.

[0030] **Fig. 2** is a schematic diagram of the production method of the absorbent body showing the second embodiment of the present invention.

[0031] **Fig. 3** is a schematic diagram of the production method of the absorbent body showing the third embodiment of the present invention.

[0032] **Fig. 4** is a partial perspective view of the outer surface of the pattern drum of the present invention.

[0033] **Fig. 5** is a partial sectional view of the pattern drum showing the state of absorbent material layer formed on the outer surface thereof.

[0034] **Fig. 6(A)** is a sectional view of the absorbent body produced according to the production method of the present invention.

[0035] **Fig. 6(B)** is a sectional view of the absorbent body produced according to the production method of the present invention.

[0036] **Fig. 6(C)** is a sectional view of the absorbent body produced according to the production method of the present invention.

[0037] **Fig. 6(D)** is a sectional view of the absorbent body produced according to the production method of the present invention.

[0038] **Fig. 7** is a perspective view of the absorbent material layer produced according to the production method of the present invention as shown in **Fig. 2**.

[0039] **Fig. 8** is a perspective view of the absorbent material layer produced according to the production method of the present invention as shown in **Fig. 3**.

[0040] **Fig. 9** is a perspective view of the absorbent material layer produced according to the production method of the present invention as shown in **Fig. 3**.

[0041] **Fig. 10** is a perspective view of the absorbent material layer produced according to the production method of the present invention as shown in **Fig. 3**.

[0042] **Fig. 11** is a perspective view of the absorbent material layer produced according to the production method of the present invention as shown in **Fig. 3**.

[0043] **Fig. 12** is a perspective view of the absorbent material layer produced according to the production method of the present invention as shown in **Fig. 3**.

[0044] **Fig. 13** is a schematic diagram showing the conventional production method of the absorbent body.

[0045] **Fig. 14** is a schematic diagram showing the conventional production method of the absorbent body.

[0046] **Fig. 1** is an explanatory diagram showing the first embodiment of the present invention.

[0047] According to the production method of the absorbent body shown in **Fig. 1**, an absorbent body comprising a single absorbent material layer held between two cover sheets is produced.

[0048] A pattern drum **21** is continuously rotated around an axis **22** in the clockwise direction at a certain rotating speed. As shown in **Fig. 4**, concavities **23** are formed on an outer surface **21a** of the pattern drum **21** by predetermined intervals. The shape of the concavity **23** is like a sand-glass. Mesh **23a** are formed at the bottom of the concavity **23** having a screen of 60 meshes (having an opening of 0.246mm) according to the standard of Tyler, U.S.A.

[0049] As shown in **Fig. 1**, a pulp supplier **24** for supplying absorbent fibers such as crushed pulps and a supply nozzle **25** for supplying particulate SAP (super-absorbent polymers) are provided above the pattern drum **21**, facing the outer surface **21a** thereof. The relative position between the supply nozzle **25** and the pulp supplier **24** can be determined appropriately depending

on the desired position of supplying the SAP to the crushed pulps.

[0050] The SAP can be made of polyacrylic acid, sodium polyacrylate, polyacrylamide, polyacrylonitrile, polyvinyl alcohol, an additional polymer of maleic anhydride, a polyether, a condensed polymer, a polysaccharide such as starch or cellulose, a protein such as collagen, or the like. Examples of the SAPs include: a cross-linked compound of sodium polyacrylate, a graft copolymer of starch having sodium polyacrylate or a graft copolymer of cellulose having polyacrylonitrile chains.

[0051] A suction chamber **26** is provided inside the pattern drum **21**, facing the pulp supplier **24** and the supply nozzle **25**. Also, a pressure chamber **27** is provided inside the pattern drum **21**, facing the inside face of the concavity **23** which is moved to the bottom of the pattern drum **21**. The suction chamber **26** sucks the air through the mesh **23a** of the concavity **23** when the concavity **23** is moved to the top position. The pressure chamber **27** pressures the air through the mesh **23a** of the concavity **23** when the concavity **23** is moved to the bottom position.

[0052] A cover tissue **31** which becomes a first cover sheet of the absorbent body is drawn from a roll **31a** rotating around an axis **32**, wound around the outer surface **21a** of the pattern drum **21** and thereafter forwarded to the left as shown in **Fig. 1**. A carrier tissue **33** which becomes a second cover sheet of the absorbent body is drawn from a roll **33a** rotating around an axis **34** and thereafter forwarded continuously to the left at a certain speed as shown in **Fig. 1**.

[0053] The carrier tissue **33** is forwarded at the speed of **V1** by the force of a conveyor (not shown) being proceeded by the rotation of conveyor rolls provided at the left of the pattern drum **21**. The cover tissue **31** is forwarded to the left at the speed of **V2**, after going around the outer surface **21a** of the pattern drum **21**. The speed **V1** and **V2** are set equal to each other.

[0054] As shown in **Fig. 5**, the cover tissue **31** drawn from the roll **31a** is laid along (or adapted to) the inner surface of the concavity **23** to form a concave shape and thereafter goes around in the clockwise direction together with the outer surface **21a** of the pattern drum **21**. The rotating speed of the outer surface **21a** of the pattern drum **21** is set almost equal to the forwarding speed **V1** of the carrier tissue **33**. However, since the cover tissue **31** is laid along the inner surface of the concavity **23**, the speed **V3** of drawing out the cover tissue **31** from the roll **31a** is set slightly faster than the speed **V1** or **V2**.

[0055] Next, the production method of the absorbent body shown in **Fig. 1** is explained in detail.

[0056] The pattern drum **21** is rotated in the clockwise direction at a certain speed, and the cover tissue **31** which becomes the first cover sheet of the absorbent body is supplied to the outer surface **21a** of the pattern drum **21**. When the concavity **23** is moved to the top of the pattern drum **21** (i.e., above the suction chamber **26**), the sucking force of the suction chamber **26** is applied to the cover tissue **31** through the mesh **23a**, and thereby the cover tissue **31** is laid along the surface of the concavity **23** to be deformed in a concave shape.

[0057] At this timing, the crushed pulps are supplied into the concavity **23** by the pulp supplier **24** and the particulate SAP are supplied into the concavity **23** from the supply nozzle **25**. The crushed pulps and the SAP are sucked into the concavity **23** through the mesh **23a** and the cover tissue **31**. Consequently, the cover tissue **31** is laid along the inner surface of the mesh **23a** in the concavity **23** and thereby the absorbent material layer **35** comprised of a mixture of the crushed pulps and the SAP is formed on the cover tissue **31** as shown in **Fig. 5**. The shape of this absorbent material layer **35** is the same as the shape of the concavity **23** opening upward. Thus, in the case of using the pattern drum **21** shown in **Fig. 4**, the shape of this absorbent material layer **35** can be formed in a sand-glass shape. By setting up the relative position of the supply nozzle **25** and the pulp supplier **24** as shown in **Fig. 1**, the content of SAP in the absorbent material layer **35** can be arranged such that more of the SAP exist at the position proximate to the cover tissue **31**.

[0058] On the other hand, the carrier tissue **33** is supplied from the roll **33a** and is forwarded toward underneath the pattern drum **21**. When the concavity **23** is moved to the bottom of the pattern drum **21** and faced the carrier tissue **33**, the absorbent material layer **35** and the cover tissue **31** are separated from the concavity **23** by the pressure chamber **27**. Thus the absorbent material layer **35** is transferred to the carrier tissue **33** together with the cover tissue **31**. In this process, an air pressure force is applied to the cover tissue **31** by the pressure chamber **27** to push out the absorbent material layer **35** and the cover tissue **31** from the concavity **23** of the pattern drum **21**. Incidentally, although it is preferable to push out the absorbent material layer **35** and the cover tissue **31** by the pressure chamber **27**, the absorbent material layer **35** may be separated from the concavity **23** by applying some other force to the cover tissue **31** in the direction of the carrier tissue **33**.

[0059] As a result, a laminated body comprising the carrier tissue **33** and the cover tissue **31** having the absorbent material layers **35** at predetermined intervals between them is produced. By cutting this laminated body in a predetermined dimension at a position between adjacent absorbent material layers **35** by a cutter such as a rotary cutter, the individual absorbent bodies are produced.

[0060] In the production of this laminated body (absorbent body), a hot melt type adhesive can be applied between the absorbent material layer **35** and the cover tissue **31** and/or between the absorbent material layer **35** and the carrier tissue **33**. Also, the cover tissue **31** and the carrier tissue **33** can be adhered with each other at the peripheral of the absorbent material layer **35**.

[0061] According to the production method described

above, because the cover tissue **31** is laid on the mesh **23a** at the bottom of the concavity **23** of the pattern drum **21** and the crushed pulps and the particulate SAP are supplied thereon, the particulate SAP do not pass into inside of the pattern drum **21** through the screen of mesh **23a**, thereby improving the yield ratio of SAP. Also, since the SAP content in the absorbent material layer **35** can be increased, water retention property of the absorbent material layer **35** can be improved. Further, since the SAP are prevented from passing through the screen of mesh **23a**, the SAP content in the absorbent material layer **35** can be freely determined and the scattering of the SAP content among the absorbent bodies can be decreased. Moreover, since the SAP having a small particle size of 100 mesh or less (which pass through a screen having an opening of 0.147mm) or 200 mesh or less (which pass through a screen having an opening of 0.074mm) can be introduced into the absorbent material layer **35**, liquid absorption speed of the absorbent material layer **35** can be accelerated.

[0062] According to the production method of the present invention, the SAP having the particle size in the range of 60mesh-200mesh can be introduced into the absorbent material layer **35** in the range of 20%-90% by weight. It is even possible to mix the SAP having smaller particle size than 200mesh into the absorbent material layer **35**.

[0063] In the production method shown in **Fig. 1**, it is possible to supply only crushed pulps without supplying SAP to form the absorbent material layer **35**. Even in this case, since the absorbent material layer **35** can be separated from the concavity **23** together with the cover tissue **31** laid along the concavity **23**, the absorbent material layer **35** can be easily removed from the concavity **23**.

[0064] **Fig. 2** is an explanatory drawing showing the second production method of the absorbent body of the present invention.

[0065] In the production method shown in **Fig. 2**, another pulp supplier **36** is provided above the carrier tissue **33** which is drawn from the roll **33a** to become the second cover sheet. Underneath the pulp supplier **36**, another suction chamber **37** is provided facing the pulp supplier **36** with the carrier tissue **33** interposed between them. Incidentally, hereinafter, the members and means having the same structure as in **Fig. 1** are indicated by using the same reference numbers. Therefore, the pattern drum **21**, the cover tissue **31** which becomes the first cover sheet of the absorbent body by being supplied to the outer surface **21a** of the pattern drum **21**, the pulp supplier **24** and the supply nozzle **25**, all shown in **Fig. 2**, are the same as those shown in **Fig. 1**.

[0066] According to the production method shown in **Fig. 2**, the carrier tissue **33** which becomes the second cover sheet of the absorbent body is drawn from the roll **33a** and forwarded continuously at a certain speed **V1**. Crushed pulps are supplied on the carrier tissue **33** from the pulp supplier **36**. These crushed pulps are sucked to the carrier tissue **33** by the air suction force generated by the suction chamber **37** to form another absorbent material layer **40** in a continuous strip shape on the carrier tissue **33**.

[0067] Like the production method shown in **Fig. 1**, at the time the absorbent material layer **40** and the carrier tissue **33** are reached underneath the pattern drum **21**, the absorbent material layer **35** formed at the concavity **23** of the pattern drum **21** is separated from the concavity **23** together with the cover tissue **31** to be laid on the absorbent material layer **40**. By this process, a double layered absorbent material can be formed between the carrier tissue **33** and the cover tissue **31**. Consequently, a laminated body, comprised of the carrier tissue **33** and cover tissue **31** with the absorbent material having a double layered structure interposed between them, can be produced. By cutting this laminated body by a cutter such as a rotary cutter in a predetermined dimension, the individual absorbent bodies are produced.

[0068] The absorbent material layer **35** and the cover tissue **31** can be adhered with each other by using a hot melt type adhesive. Also, the absorbent material layer **40** and the carrier tissue **33** can be adhered with each other by using the same type of adhesive. Further, the cover tissue **31** and the carrier tissue **33** can be adhered with each other at the peripheral of the double layered absorbent material formed of the absorbent material layer **35** and the absorbent material layer **40**.

[0069] According to the production method shown in **Fig. 2**, since no tissue is necessary between the absorbent material layer **40** and the absorbent material layer **35**, an absorbent body having an absorbent material layer of a double layer structure can be produced at low cost.

[0070] According to the production method shown in **Fig. 2**, further, SAP can be introduced only into the absorbent material layer **35** while introducing no SAP into the absorbent material layer **40**. Or else, the absorbent material layer **40** also can be formed of the mixture of crushed pulps and SAP by installing another supply nozzle of SAP with the pulp supplier **36**. In this case, at forming the absorbent material layer **35** and the absorbent material layer **40** each from the mixture of crushed pulp and SAP, it is possible to make the contents and particle sizes of the SAP different between the absorbent material layer **35** and the absorbent material layer **40**.

[0071] Alternatively, it is also possible that the absorbent material layer **35** is formed of crushed pulps alone while the absorbent material layer **40** is formed of the mixture of crushed pulps and SAP.

[0072] **Fig. 3** is an explanatory drawing showing the third production method of the absorbent body of the present invention.

[0073] In this production method, a first pattern drum **21A** and a second pattern drum **21B**, which have the same structure as that of the pattern drum **21** shown in **Figs. 1, 2, 4** and **5**, are provided in parallel. The first pattern drum **21A** is continuously rotating in the clock-

wise direction, and the second pattern drum **21B** is continuously rotating in the counterclockwise direction both at the same speed. Also similar to the pattern drum **21**, concavities **23A** and concavities **23B**, the bottoms of which are formed as mesh having a screen of 60 meshes, are provided on the outer surface of the pattern drum **21A** and on the outer surface of the pattern drum **21B** respectively. The concavity **23A** and the concavity **23B** may be formed in the same or different shapes.

[0074] A pulp supplier **24A** and a supply nozzle **25A** for SAP are provided above the pattern drum **21A** and a suction chamber **26A** is provided inside the pattern drum **21A**. Similarly, a pulp supplier **24B** and a supply nozzle **25B** for SAP are provided above the pattern drum **21B** and a suction chamber **26B** is provided inside the pattern drum **21B**.

[0075] A pressure chamber **27A** and a pressure chamber **27B** are provided inside the pattern drum **21A** and the pattern drum **21B** respectively. The pressure chambers **27A** and **27B** are facing each other at the position where the outer surfaces of the pattern drum **21A** and the pattern drum **21B** are facing each other with the cover tissues **31A** and **31B** interposed between them.

[0076] According to the production method of the absorbent body as shown in **Fig. 3**, the cover tissue **31A** is supplied to the outer surface of the first pattern drum **21A** and laid along the inside of the concavity **23A**. Crushed pulps and SAP are supplied from the pulp supplier **24A** and supply nozzle **25A** respectively into the concavity **23A** to form a first absorbent layer **35A** comprised of a mixture of crushed pulps and SAP on the cover tissue **31A**, the shape of which is the same as that of the concavity **23A**. Also, the cover tissue **31B** is supplied to the outer surface of the second pattern drum **21B**. This cover tissue **31B** is laid along the inside of the concavity **23B** of the second pattern drum **21B**. Crushed pulps and SAP are supplied from the pulp supplier **24B** and the supply nozzle **25B** respectively to form a second absorbent material layer **35B**, the shape of which is the same as that of the concavity **23B**.

[0077] At the position where the outer surfaces of the pattern drum **21A** and the pattern drum **21B** face each other with the cover tissue **31A** and **31B** interposed between them, the cover tissue **31A** is separated from the concavity **23A** together with the absorbent material layer **35A** by the pressure chamber **27A**, and the cover tissue **31B** is separated from the concavity **23B** together with the absorbent material layer **35B** by the pressure chamber **27B**. Thereafter, the absorbent material layer **35A** and the absorbent material layer **35B** are superposed with each other to have a double layer structure, between the cover tissue **31A** and the cover tissue **31B**, thereby forming a laminated body.

[0078] Subsequently, such laminated body is cut into pieces in a predetermined dimension to produce the individual absorbent bodies.

[0079] The absorbent material layer **35A** and the cover tissue **31A** can be adhered each other by using a hot melt type adhesive. Also, the absorbent material layer **35B** and the cover tissue **31B** can be adhered each other by using the same type of adhesive. It is also possible that the cover tissue **31A** and the cover tissue **31B** are adhered each other at the peripheral of the absorbent material having a double layer structure formed of the absorbent material layer **35A** and the absorbent material layer **35B**.

[0080] In this production method, since no tissue is necessary between the absorbent material layer **35A** and the absorbent material layer **35B**, an absorbent body having double layered absorbent material structure can be produced at low cost.

[0081] Further, SAP can be introduced only into either one of the absorbent material layer **35A** or the absorbent material layer **35B**. Also, it is possible to make the contents and particle sizes of the SAP different between the absorbent material layer **35A** and the absorbent material layer **35B**.

[0082] Furthermore, instead of laminating (or superposing) the absorbent material layers **35A** and **35B**, it is also possible to combine (or mate) the absorbent material layers **35A** and **35B** adjacent each other in a horizontal plane to form a single-flat layered structure between the cover tissues **31A** and **31B** as explained below (with reference to **Fig. 10 - 12**).

[0083] Next, the structure of the absorbent bodies produced according to the above described production methods is explained.

[0084] **Fig. 6(A)** shows the absorbent body produced according to the production method shown in **Fig. 1**. This absorbent body is comprised of the carrier tissue **33** and the cover tissue **31** with the absorbent material layer **35** interposed between them. The absorbent material layer **35** is formed of crushed pulps or the mixture of crushed pulps and SAP.

[0085] **Fig. 6(B)** shows the absorbent body produced according to the production method shown in **Fig. 2** or **Fig. 3**.

[0086] In the production method shown in **Fig. 2**, the absorbent material layer **40** and the absorbent material layer **35** formed in the concavity **23** of the pattern drum **21** are laminated each other and such laminated layers are held between the carrier tissue **33** and the cover tissue **31**.

[0087] One example of the shape of the laminated layers according to the production method shown in **Fig. 2** is illustrated in **Fig. 7**. The absorbent material layer **35** in a rectangular framework shape is laminated on the absorbent material layer **40**. This absorbent material layer **35** in a rectangular framework shape can be formed by forming the concavity **23** of the pattern drum **21** in a rectangular framework shape.

[0088] The absorbent body having the laminated layers shown in **Fig. 7** may be used for an excrement absorption sheet for pets, or the like, which can be produced by providing a liquid non-permeable backing sheet at the bottom of the absorbent body and a liquid

permeable top sheet on the top of the same. The absorbent material layer **40** is formed of crushed pulps alone or the mixture of crushed pulps and SAP, and the absorbent material layer **35** in a rectangular framework shape is formed of the mixture of crushed pulps and SAP. In this case. it is desirable that the absorbent material layer **35** contains more and/or finer SAP than the absorbent material layer **40**. The SAP contained in the absorbent material layer **35** preferably have a particle size below 60 mesh, more preferably below 100 mesh, and the SAP content in the absorbent material layer **35** is 20% by weight or more, preferably 30% by weight or more, and more preferably, in the range of 50% -90% by weight. In such structure, the absorption sheet can prevent the urine excrement from leaking outside because the absorbent material layer **35** in a rectangular framework shape absorbs the urine excreted on the absorbent material layer **40** very quickly.

[0089] Incidentally, although one of the advantages of the production method shown in **Fig. 2** is that no tissue is necessary between the absorbent material layer **40** and the absorbent material layer **35**, it is preferable for the excrement absorption sheet for pets that the area surrounded by the absorbent material layer **35** is colored. Therefore, in the production method shown in **Fig. 2**, a colored tissue **51** may be supplied on the absorbent material layer **40** such that the colored tissue **51** is placed between the absorbent material layer **40** and the absorbent material layer **35** as shown in **Fig. 6(D)**, if the absorbent body is used for the excrement absorption sheet for pets. In this case, the colored tissue **51** at the area surrounded by the framework shaped absorbent material layer **35** can be seen from outside through the cover tissue **31** and the top sheet.

[0090] The structure of the absorbent body produced according to the production method shown in **Fig. 3** is such that the absorbent material layer **35B** formed at the concavity **23B** is placed on the cover tissue **31B** and the absorbent material layer **35A** formed at the concavity **23A** is laminated on the absorbent material layer **35B** and the cover tissue **31A** covers the top face thereof, as shown in **Fig. 6(B)**. In this production method shown in **Fig. 3**, both the absorbent material layers **35A** and **35B** can be formed in any desired shapes.

[0091] **Fig. 8** and **Fig. 9** each show an example of the shape formed by the absorbent material layer **35B** and the absorbent material layer **35A** in the absorbent body produced according to the production method as shown in **Fig. 3**.

[0092] In **Fig. 8**, the absorbent material layer **35A** and the absorbent material layer **35B** are both formed in a sand-glass shape having the same dimensions. This combination of absorbent material layers can be made by forming the concavity **23A** of the first pattern drum **21A** and the concavity **23B** of the second pattern drum **21B** in the same sand-glass shape and size.

[0093] In **Fig. 9**, the absorbent material layer **35A** at the upper side is in a sand-glass shape and the absorbent material layer **35B** at the lower side is in a rectangular shape. The absorbent material layer **35B** at the lower side is attached to the absorbent material layer **35A** at the upper side only at the central portion in the transversal direction.

[0094] The absorbent bodies having such layers **35A** and **35B** as shown in **Figs. 8** and **9** can be used for a disposable diaper, sanitary napkin, urine absorption pad or the like, which can be produced by providing a liquid non-permeable backing sheet at the bottom of the absorbent body, and a liquid permeable top sheet at the top thereof.

[0095] In those absorbent bodies shown in **Figs. 8** and **9**, the absorbent material layer **35A** at the upper side is comprised of crushed pulps alone or the mixture of crushed pulps and SAP, and the absorbent material layer **35B** at the lower side is comprised of the mixture of the crushed pulps and SAP. In this case, it is desirable that the absorbent material layer **35B** at the lower side contains more and/or finer SAP than the absorbent material layer **35A** at the upper side. The SAP contained in the absorbent material layer **35B** preferably have a particle size below 60 mesh, more preferably below 100 mesh, and the SAP content in the absorbent material layer **35B** is 20% by weight or more, preferably 30% by weight or more, and more preferably, in the range of 50% -90% by weight. In such structure, the excrement or secretion liquid introduced to the absorbent material layer **35A** at the upper side is moved toward the absorbent material layer **35B** at the lower side owing to the strong absorption ability of the more and/or finer SAP contained in the absorbent material layer **35B**, before the excrement or secretion liquid spreads all over the absorbent material layer **35A** at the upper side. Therefore, the excrement or secretion liquid is prevented from flowing back to the top sheet. In the absorbent body having such structure as shown in **Fig. 9**, further, since the excrement or secretion liquid introduced to the central portion of the absorbent material layer **35A** at upper side is strongly absorbed by the more and/or finer SAP contained in the absorbent layer **35B** at the lower side, it can prevent the excrement or secretion liquid not only from flowing back to the top sheet but also from leaking to the side of the absorbent material layer **35A**.

[0096] Incidentally, by modifying the production method shown in **Fig. 3**, an absorbent body having such a three layered absorbent material as shown in **Fig. 6(C)** can be produced. That is, by providing and laminating another absorbent material layer **52** formed on another cover tissue **53** onto the laminated body produced by the production method shown in **Fig. 3**, the absorbent body having a three layered absorbent material can be produced.

[0097] Further, in the production method shown in **Fig. 3**, it is also possible to mate (or combine) the absorbent material layers **35A** and **35B** with each other to form a flat absorbent material layer as shown in **Figs. 10-12** between the cover tissues **31A** and **31B**, instead

of laminating them with each other. In this case, the absorbent material layers **35A** and **35B** have different absorption properties from each other, so that the resulting flat absorbent material layer has partially different absorption property.

[0098] In **Fig. 10**, the absorbent material layer **35A** is formed in a rectangular shape, while the absorbent material layer **35B** is formed of four separate parts, each two of them are lined in parallel in left and right. The absorbent material layer **35A** is mated with the absorbent material layer **35B** within the space provided by the four separate parts of the absorbent material layer **35B** to form a flat absorbent material layer.

[0099] In **Fig. 11**, the absorbent material layer **35A** is formed in a rectangular shape, while the absorbent material layer **35B** is formed of two separate absorbent material layers in a rectangular shape lined in parallel. The absorbent material layer **35A** is mated with the absorbent material layer **35B** within the space provided by the two separate rectangular parts of the absorbent material layer **35B** to form a flat absorbent material layer.

[0100] In **Fig. 12**, the absorbent material layer **35A** is formed in a rectangular shape, while the absorbent material layer **35B** is formed in a rectangular framework shape. The absorbent material layer **35A** is mated with the absorbent material layer **35B** within the space provided by the rectangular framework shape of the absorbent material layer **35B** to form a flat absorbent material layer.

[0101] In the flat absorbent material layer shown in **Fig. 10**. the absorbent material layer **35B** contains crushed pulps alone or the mixture of crushed pulps and SAP, and the absorbent material layer **35A** contains the mixture of crushed pulps and more and/or finer SAP than the absorbent material layer **35B**. The particle size of the SAP in the absorbent material layer **35A** is for instance less than 60 mesh or less, preferably less than 100 mesh, and the contents of the SAP in the absorbent material layer **35A** is 20% by weight or more, preferably 30% by weight or more and more preferably, in the range of 50%- 90% by weight. In such structure, the excrement or secretion liquid is absorbed rapidly by the absorbent material layer **35A** placed at the central position and the volume of liquid retention at the absorbent material layer **35A** becomes large. Therefore, the spreading of the liquid to the direction of absorbent material layer **35B** is slowed and the leakage of the liquid to the side is prevented.

[0102] In the flat absorbent material layer shown in **Fig. 11**, the absorbent material layer **35A** contains crushed pulps alone or the mixture of crushed pulps and SAP, and the absorbent material layer **35B** contains the mixture of crushed pulps and more and/or finer SAP than the absorbent material layer **35A**. In such structure, since the liquid introduced to the absorbent material layer **35A** at the central position is moved to the absorbent material layer **35B** at the sides and dispersed, the liquid introduced to the absorbent material layer **35A** is prevented from flowing back to the top sheet and from leaking outside.

[0103] The flat absorbent material layer shown in **Fig. 12** is a modification of the laminated layers composed of absorbent material layers **35** and **40** shown in **Fig. 7**, so that the excrement liquid introduced to the absorbent material layer **35A** is absorbed by the absorbent material layer **35B** formed in a rectangular framework shape.

[0104] Incidentally, although the carrier tissue **33** and the cover tissue **31** are used as the cover sheets in the production methods shown in **Fig. 1** and **Fig. 2**, and the cover tissues **31A** and **31B** are used as the cover sheets in the production method shown in **Fig. 3**, air permeable non-woven fabrics or woven fabrics can be used as the cover sheets to produce an absorbent body instead of using the tissues.

[0105] As has been described above, according to the production method of the absorbent body of the present invention, since the cover sheet is laid along the concavity of the pattern drum and the absorbent material layer is formed on this cover sheet, the absorbent material layer can be easily separated from the concavity of the pattern drum.

[0106] Further, according to the production method of the absorbent body of the present invention, since the particulate SAP is prevented from passing into the pattern drum through the mesh at the bottom of the concavity at the time of introducing the SAP into the absorbent material layer, the yield ratio of SAP at the production of the absorbent body can be improved. Also, it makes possible to introduce very fine SAP and increase the SAP content in the absorbent material layer, so that the liquid retention property and the liquid absorption speed of the absorbent body can be easily improved.

[0107] Furthermore, according to the production method of the absorbent body of the present invention, the absorbent material layers can be easily laminated to each other without providing tissues between the layers. Also, it makes possible to vary the shapes between the absorbent material layers and to mate the absorbent material layers with each other into a single-flat layer.

[0108] While in the foregoing specification the present invention has been described in relation to preferred embodiments and many details have been set forth for purpose of illustration, it will be apparent to those skilled in the art that the present invention is susceptible to additional embodiments and that certain of the details described herein can be varied considerably without departing from the basic principles of the present invention.

[0109] As used herein, "comprises" and all its grammatical forms specifies the presence of stated features, integers, steps or components, but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

Claims

1. A production method of an absorbent body comprising the following steps of:

   supplying a first cover sheet on an outer surface of a rotating pattern drum, said pattern drum being provided with a concavity formed in a predetermined shape on the outer surface thereof;
   adapting the first cover sheet to the shape of the concavity and supplying an absorbent material into the concavity to form an absorbent material layer adapted to the shape of the concavity on the first cover sheet;
   supplying a second cover sheet toward the outer surface of the pattern drum; and
   separating the first cover sheet together with the absorbent material layer from the outer surface of the pattern drum and superposing the first cover sheet together with the absorbent material layer on the second cover sheet to produce an absorbent body comprised of the first cover sheet, the second cover sheet and the absorbent material layer interposed between the first cover sheet and the second cover sheet.

2. A production method of an absorbent body as described in Claim 1, wherein a bottom of the concavity is formed as a mesh, and a suction means is provided inside of the pattern drum for sucking air through the mesh to adapt the first cover sheet to the shape of the concavity and for sucking air through the mesh and the first cover sheet to form the absorbent material layer on the first cover sheet.

3. A production method of an absorbent body as described in Claim 2, wherein a pressure means is provided inside of the pattern drum for pressuring air through the mesh to separate the first cover sheet together with the absorbent material layer from the outer surface of the pattern drum.

4. A production method of an absorbent body as described in Claim 3, wherein the absorbent material layer comprises absorbent fibers and particulate super-absorbent polymers.

5. A production method of an absorbent body as described in Claim 4, wherein the particle size of the super-absorbent polymers is 60 mesh or less.

6. A production method of an absorbent body as described in Claim 4, wherein the content of the super-absorbent polymers in the absorbent material layer is in a range of 20%-90% by weight.

7. A production method of an absorbent body as described in Claim 1, wherein another absorbent material layer is formed on the second cover sheet, and the absorbent material layer formed on the first cover sheet is superposed on the absorbent material layer formed on the second cover sheet, between the first cover sheet and the second cover sheet.

8. A production method of an absorbent body comprising the following steps of:

   supplying a first cover sheet on an outer surface of a first pattern drum rotating, said first pattern drum being provided with a first concavity formed in a predetermined shape on the outer surface thereof;
   adapting the first cover sheet to the shape of the first concavity and supplying an absorbent material into the first concavity to form a first absorbent material layer adapted to the shape of the first concavity on the first cover sheet;
   supplying a second cover sheet on the outer surface of a second pattern drum rotating, said second pattern drum being provided with a second concavity formed in a predetermined shape on the outer surface thereof;
   adapting the second cover sheet to the shape of the second concavity and supplying an absorbent material into the second concavity to form a second absorbent material layer adapted to the shape of the second concavity on the second cover sheet; and
   separating the first cover sheet together with the first absorbent material layer from the outer surface of the first pattern drum and separating the second cover sheet together with the second absorbent material layer from the outer surface of the second pattern drum and superposing the first cover sheet together with the first absorbent material layer on the second cover sheet together with the second absorbent material layer to produce an absorbent body comprised of the first cover sheet, the second cover sheet and the first and second absorbent material layers interposed between the first cover sheet and the second cover sheet.

9. A production method of an absorbent body as described in Claim 8, wherein each bottom of the first and second concavities is formed as a mesh, and first and second suction means are provided inside of the first and second pattern drums, respectively, for sucking air through the meshes to adapt the first and second cover sheets to the shapes of the first and second concavities and for sucking air through the meshes and the first and second cover sheets to form the first and second absorbent material layers on the first and second cover sheets.

10. A production method of an absorbent body as described in Claim 9, wherein first and second pressure means are provided inside of the first and second pattern drums, respectively, for pressuring air through the meshes to separate the first and second cover sheets together with the first and second absorbent material layers from the outer surfaces of the first and second pattern drums.

11. A production method of an absorbent body as described in Claim 10, wherein the first absorbent material layer comprises absorbent fibers alone or absorbent fibers and particulate super-absorbent polymers, and the second absorbent material layer comprises absorbent fibers and particulate super-absorbent polymers.

12. A production method of an absorbent body as described in Claim 11, wherein the particle size of the super-absorbent polymers contained in the second absorbent material layer is smaller than that of the super-absorbent polymers contained in the first absorbent material layer

13. A production method of an absorbent body as described in Claim 12, wherein the particle size of the super-absorbent polymers contained in the second absorbent material layer is 60 mesh or less.

14. A production method of an absorbent body as described in Claim 11, wherein the content of the super-absorbent polymers in the second absorbent material layer is higher than that of the super-absorbent polymers in the first absorbent material layer

15. A production method of an absorbent body as described in Claim 14, wherein the content of the super-absorbent polymers in the second absorbent material layer is in a range of 20%-90% by weight.

16. A production method of an absorbent body as described in Claim 8, wherein the first absorbent material layer and the second absorbent material layer are superposed to each other.

17. A production method of an absorbent body as described in Claim 16, wherein the first absorbent material layer and the second absorbent material layer are formed in an identical shape and have different absorption properties from each other.

18. A production method of an absorbent body as described in Claim 16, wherein the first absorbent material layer and the second absorbent material layer are formed in different shapes.

19. A production method of an absorbent body as described in Claim 8, wherein the first absorbent material layer and the second absorbent material layer have different shapes and absorption properties from each other and are mated adjacent each other in a horizontal plane.

Fig. 1

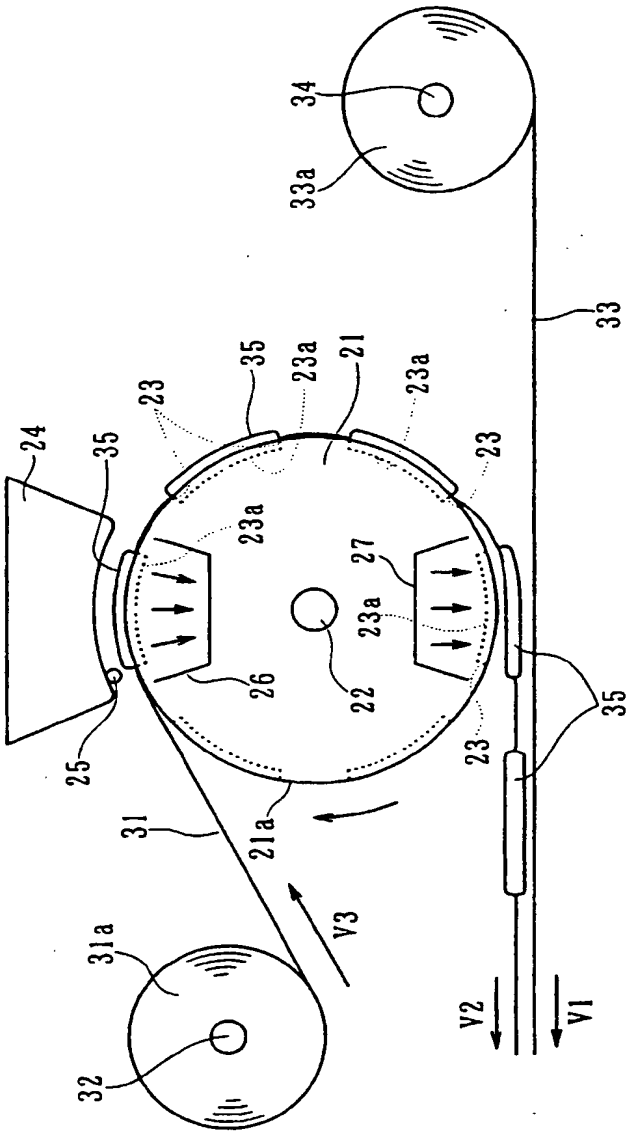


Fig. 2

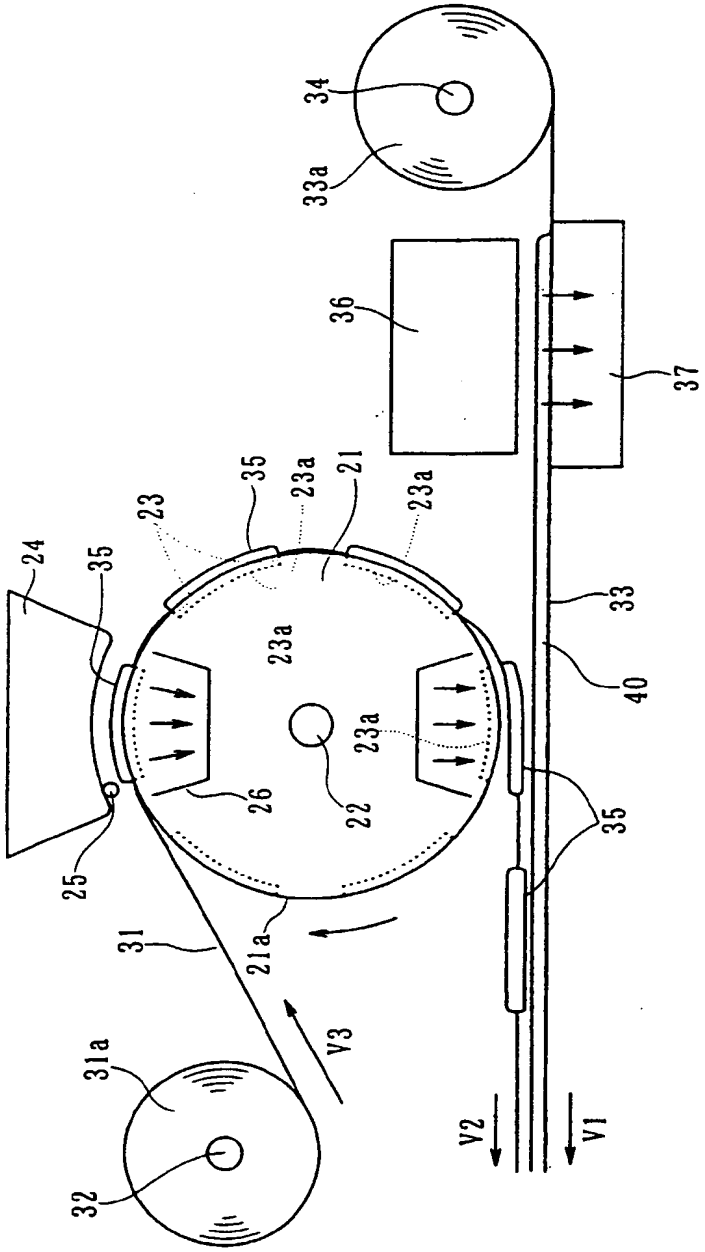


Fig. 3

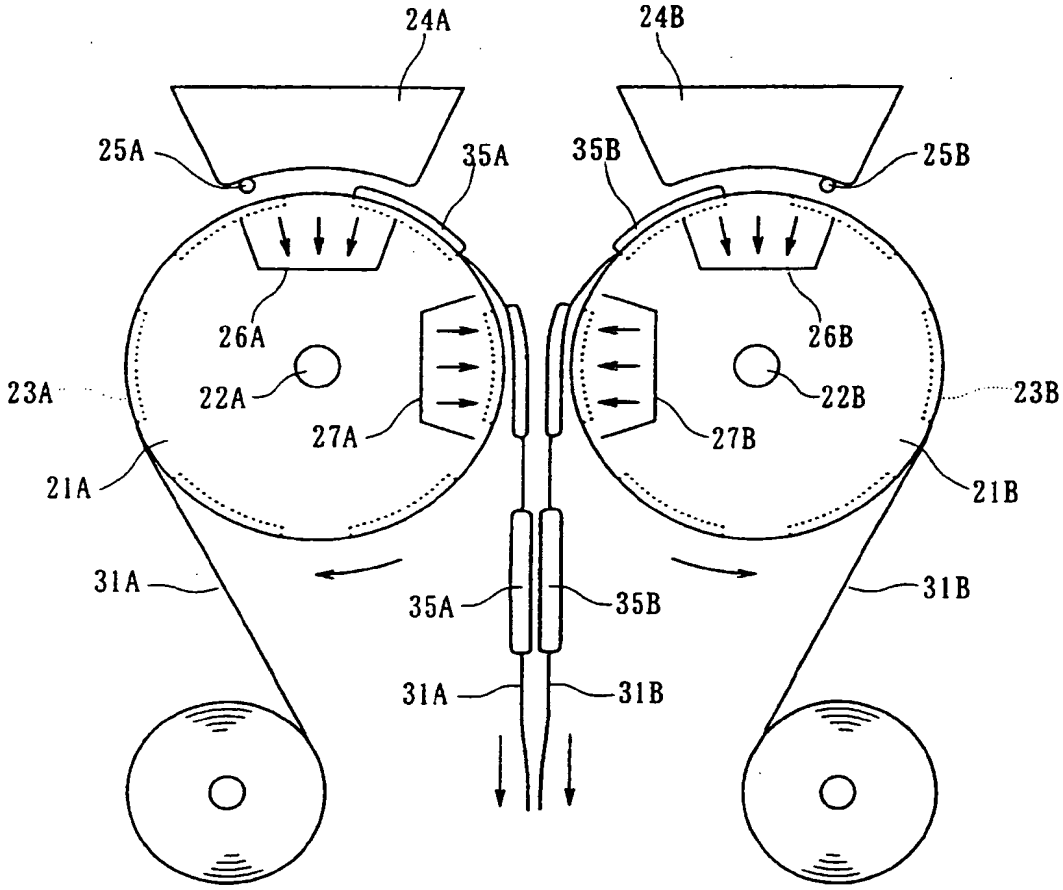


Fig. 4

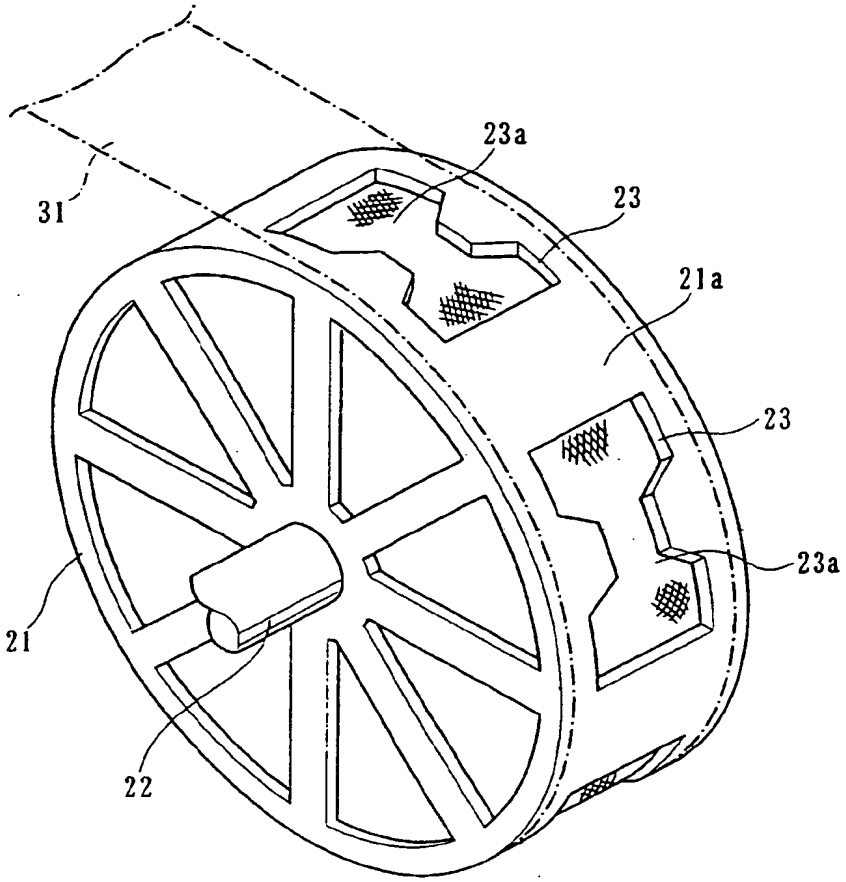


Fig. 5

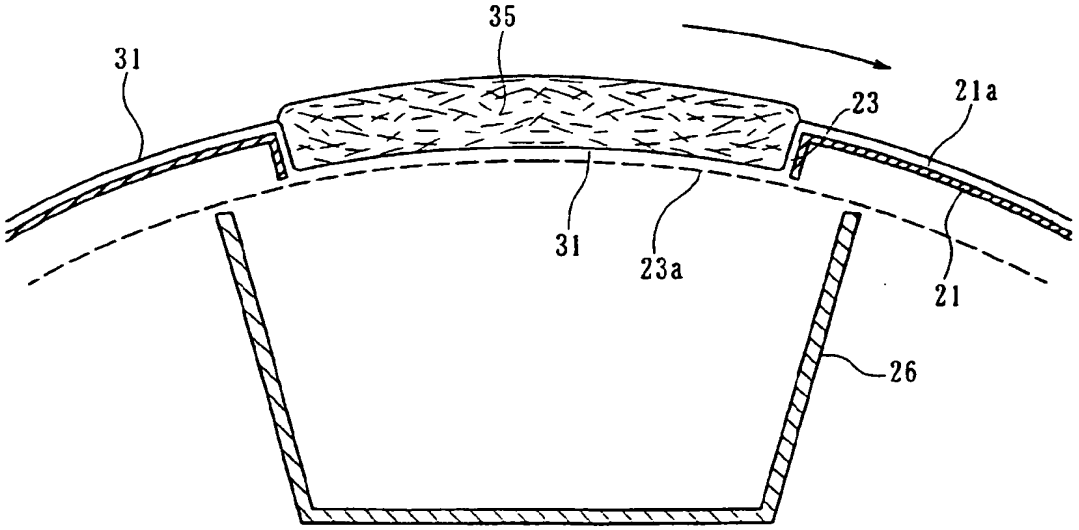


Fig. 6(A)

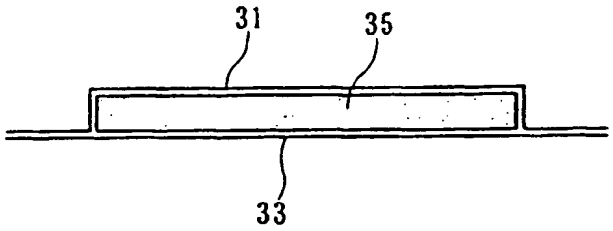


Fig. 6(B)

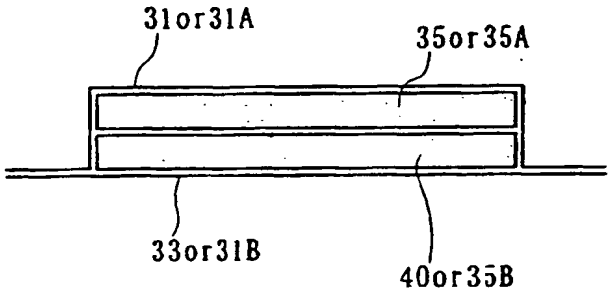


Fig. 6(C)

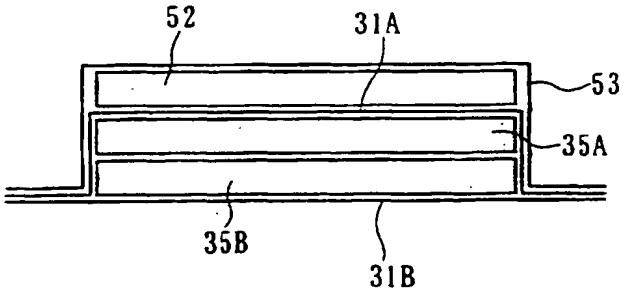


Fig. 6(D)

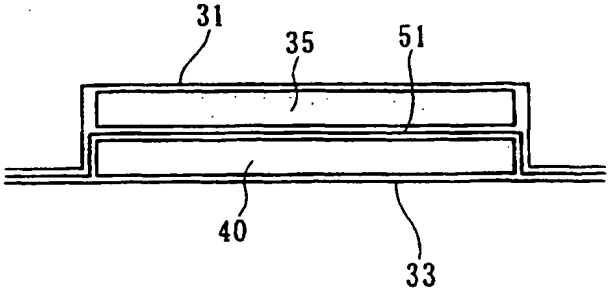


Fig. 7

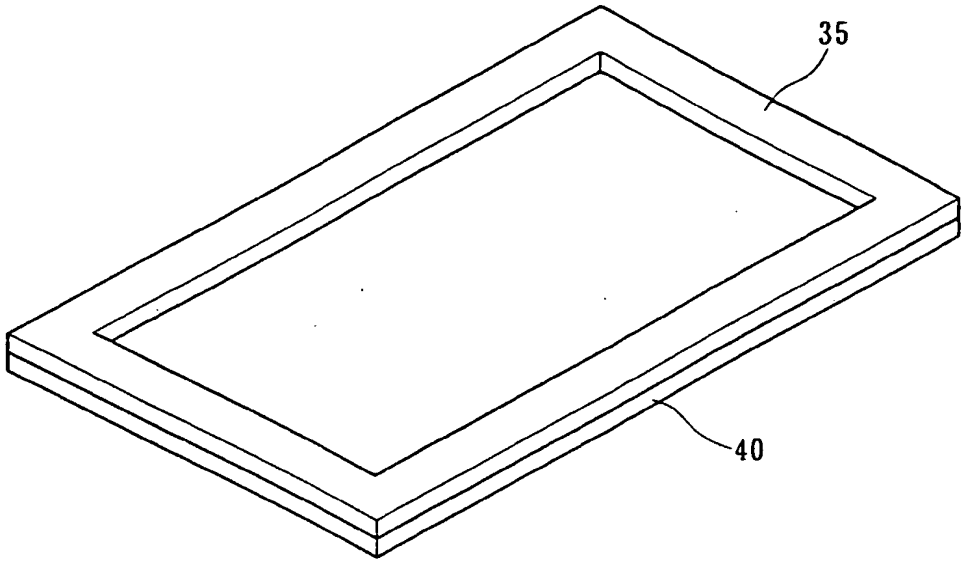


Fig. 8

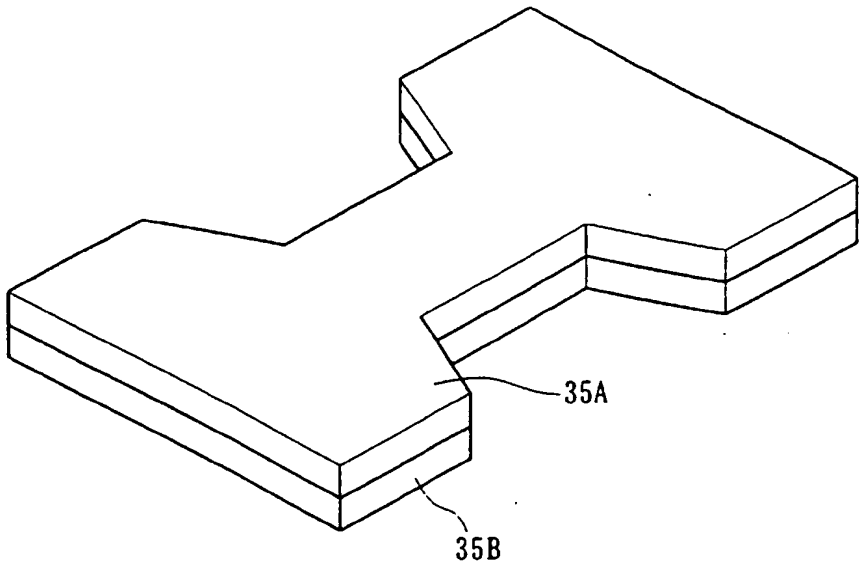


Fig. 9

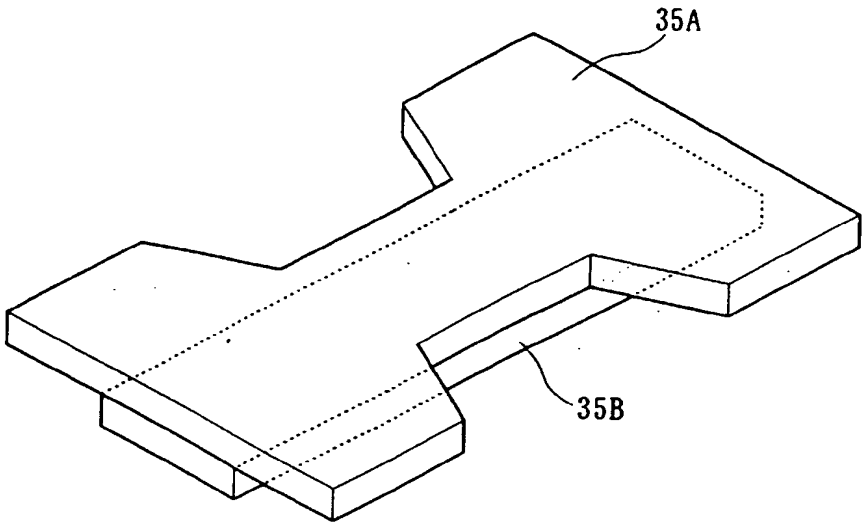


Fig. 10

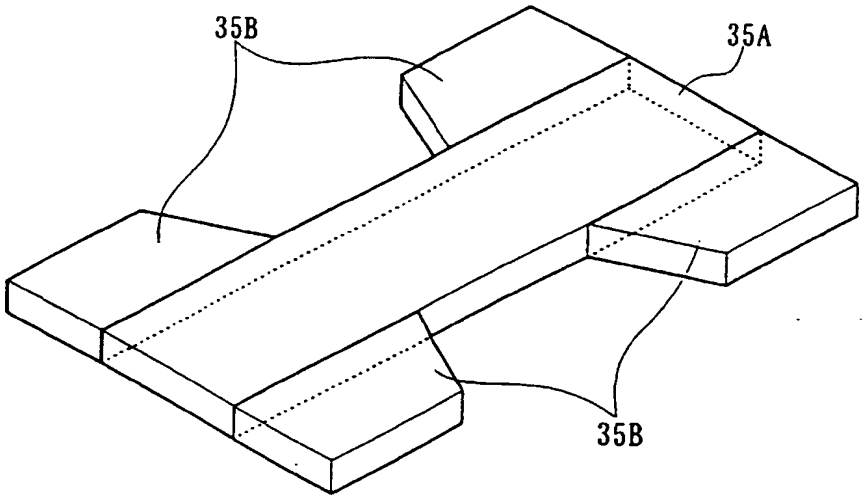


Fig. 11

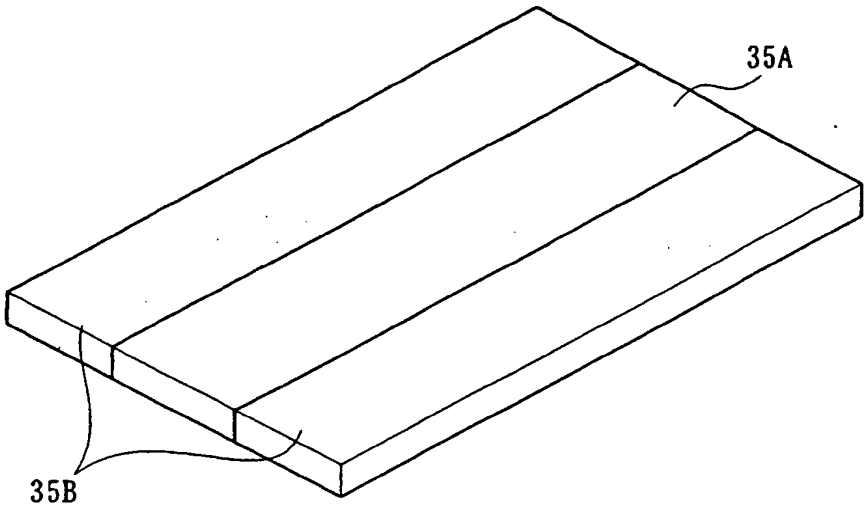


Fig. 12

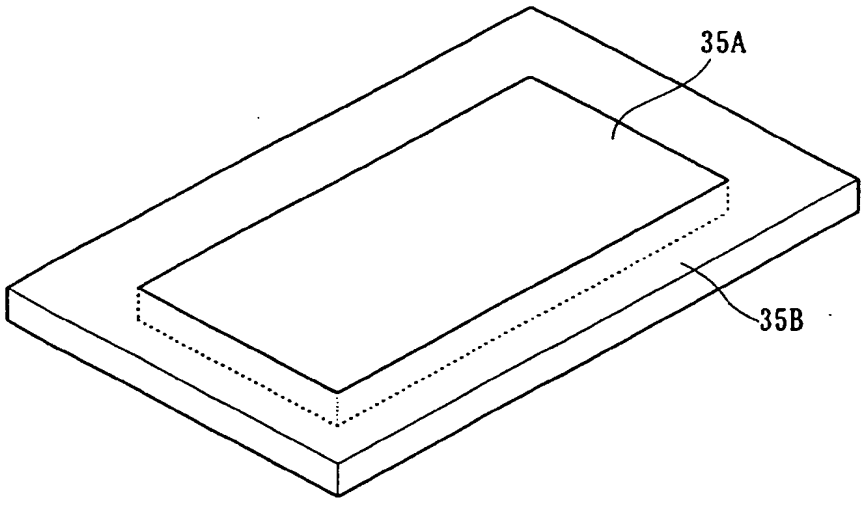


Fig. 13

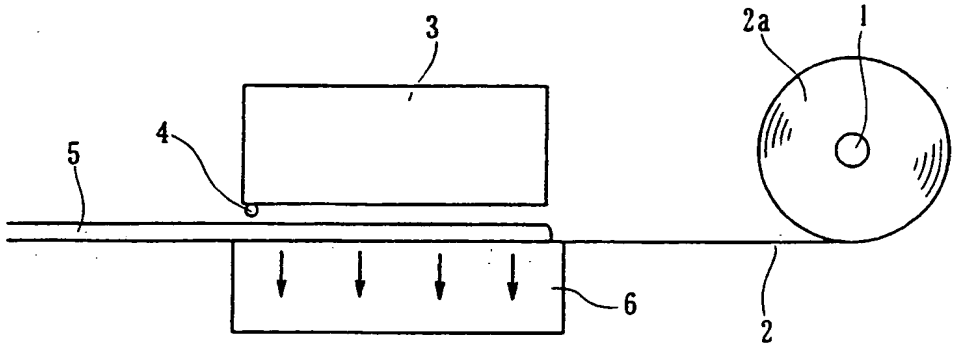
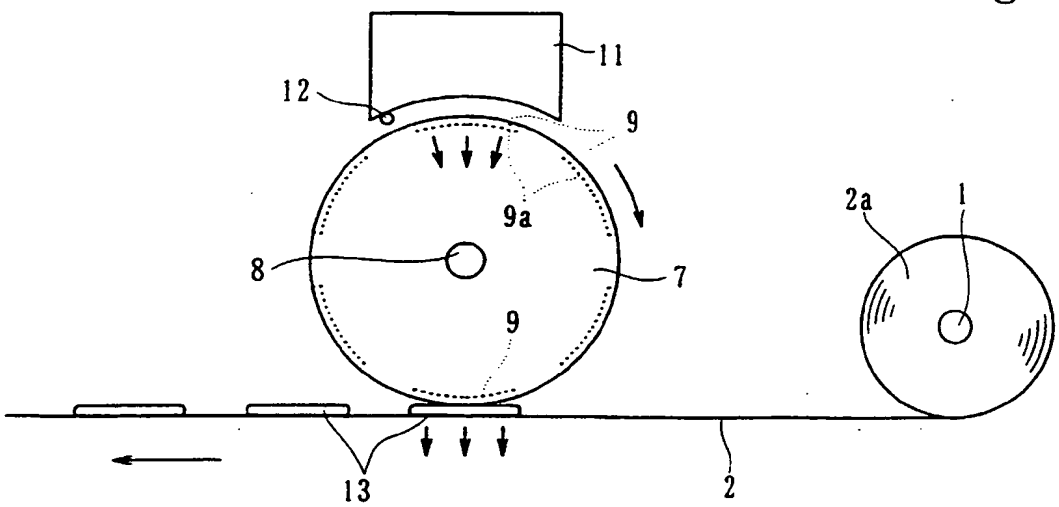


Fig. 14



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EUROPEAN SEARCH REPORT

Application Number
EP 99 30 3652

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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Place of search	Date of completion of the search	Examiner
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X : particularly relevant if taken alone
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L : document cited for other reasons

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